Chapter 3

LOW IMPACT DEVELOPMENT PLANNING AND DESIGN PROCESS

This chapter of the Guidebook describes the recommended step-by-step planning and design process for integrating Low Impact Development (LID) in development and redevelopment projects in the High Sierra areas of Placer County. It provides tips for streamlining the planning and design process. This chapter also introduces and describes recommended tools to assist both the project team tasked with creating the site design and submitting the application, and on the other side of the counter, the County planning and engineering staff responsible for reviewing and conditioning the project for the decision makers/hearing body to consider.

3.1 PROCESS OVERVIEW

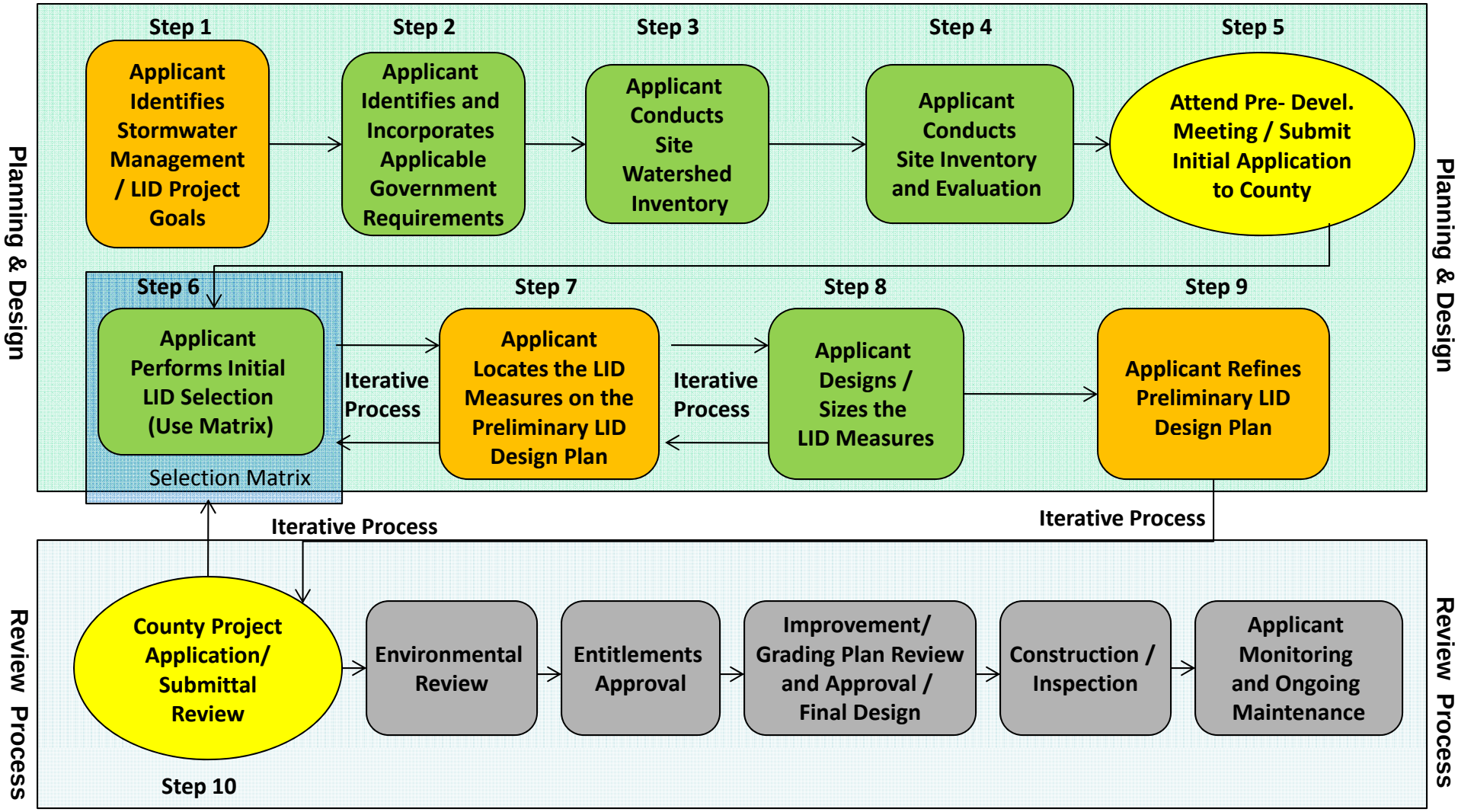
Figure 3-1 is a flowchart illustrating the recommended or ideal planning and design process for use in conjunction with this Guidebook. The process begins with development of stormwater management goals for the project, followed by research and investigations to understand the regulatory framework and unique site and surrounding area features, all of which will influence the design of the project. Next, the project applicant is encouraged to meet with permitting agency staff (e.g., in a pre-development meeting) to confirm a mutual understanding of goals and local requirements. Following this, a set of LID practices and techniques can be selected to complement the natural site features and minimize impacts of the constructed project. This is an iterative process, with project goals, layout and LID features adjusted until the final plan is ready for submittal to the permitting agency.

> The design process outlined in the LID Guidebook is intended to be adaptable to a wide range of sites, economic constraints, and regulatory requirements, including those associated with new development, redevelopment, and retrofits, which may be subject to a variety of water quality, water quantity, and other requirements.

The process is tailored for the typical local development planning and review process in the High Sierra areas of Placer County. Note that the LID process is nested within the County's overall development review process, which includes other steps (such as environmental impact/CEQA analysis and flood control/drainage design) not addressed by this Guidebook. Furthermore, the order in which the steps appear on Figure 3-1 may not be the same for every project.

Figure 3-1. Low Impact Development (LID) Planning and Design Process Overview

(Use this Flowchart in conjunction with LID Planning and Design Checklist)



Note: This is "ideal case", not typical of all projects. Actual LID process is more iterative than shown, but the LID process has been displayed in a linear fashion to more easily identify steps of the LID design process.

Revised March 2012

3.2 TIPS FOR STREAMLINING THE PROCESS

Incorporate LID Early in the Planning Process

LID is not intended to be implemented as an afterthought, with a few best management practices placed on an otherwise conventionally designed site. Consideration of natural resources such as topography, soils, groundwater, vegetation, and drainage flow paths not only influence the placement of buildings and paved surfaces, but also the selection and location of LID features. The various site elements should be designed in an integrated fashion, with LID/stormwater management goals considered at the earliest planning stages of a project, as shown in the recommended process flowchart (Figure 3-1).

A common mistake is to wait until the site's footprint and drainage plan have been completed, to attempt to incorporate LID. In the experiences of large urban communities that received stormwater permits two decades ago and have therefore been requiring stormwater treatment for many years, this type of delay results in lack of choices for the designer and property owner. Often, if LID planning is not incorporated early in the planning process, project applicants are forced to use below-ground devices which can be expensive to install and maintain, give up planned building space, or conduct a costly re-design of the site's drainage plan or overall layout. When LID is considered from the beginning, many designs can adequately meet the requirements for a project without significant loss of building space or additional costs.

Balance LID with Other Requirements

The LID site design process entails the balancing and rebalancing of a myriad of requirements placed on today's development projects in addition to those for water quality protection and water quantity management. Table 3-1 presents a few examples of acceptable LID approaches which may complement other regulatory requirements (consult local permitting authorities to verify acceptance before proceeding with design).

Table 3-1. Relationship of LID and Other Regulatory Requirements

Requirement	Conventional Approach	Alternative LID Approach
American with Disabilities Act (ADA)	Specify smooth conventional pavement material (e.g., concrete)	Use selected types of pervious pavement with smooth/relatively smooth surfaces (e.g., permeable concrete and asphalt)
Water Conservation Regulations	Landscaping and swales planted with non-native grasses (sod)	Swales and bioretention planted with drought-tolerant vegetation Eco-friendly landscaping
Fire Agency Requirements	Specify wide streets and large cul-de-sacs to accommodate large trucks Prefer conventional pavements with presumed strength characteristics to support trucks	Prohibit parking on one or both sides of street Install parallel parking cut-outs/pull-outs with main unobstructed traffic lanes Use selected types of pervious pavement (e.g., permeable concrete and asphalt) for low traffic and emergencyfire access lanes capable of supporting the local fire agency's heaviest fire apparatus (e.g., 40,000 lb truck)
Snow Plowing/Storage Requirements	Specify wide streets within minimal obstructions to accommodate plows	Narrow streets with no parking on either side may work in some instances More work is needed in the future to identify additional acceptable LID approaches (in most cases, parallel parking cut-outs may pose an obstacle to plowing and snow storage operations)

Use An Integrated Design Team Approach

For successful LID design, the project engineers, architect and landscape designer should work together as a team throughout the process to achieve a balance that meets all requirements within the project budget. The team should consult early with the planners and engineers at the local permitting agency in order to streamline the process. In addition, it is important to inform and involve the project owner along the way to avoid last minute decisions that could negate or significantly impact the entire design process and add to the cost of design and/or affect the project schedule.

All members of the design team (architect, landscape architect and civil engineer) should meet and discuss LID opportunities as early as possible in the project design phase.

Success with the Integrated Design Team Approach: Mercy Housing, Sacramento, CA

In 2008, Mercy Housing completed its Colonia San Martin project in Sacramento County, California, a 60-unit transit-oriented infill development with a density of 20 units per acre. The project is widely recognized as the first affordable housing project in Sacramento with solar power and a wide array of other sustainable features, including disconnected downspouts and vegetated stormwater quality bioswales, extensive use of drought-tolerant water efficient landscaping, community gathering areas, and a community garden and edible fruit trees to provide food for the residents. The project decreased directly connected impervious area from 95% to 3% and reduced stormwater runoff to more than 60% ***below*** the predevelopment condition. Embracing the "Start at the Source" concept and recommendations in the Sacramento Stormwater Quality Design Manual, the architect facilitated early and continued meetings and correspondence with the entire design team. The question of how to manage stormwater at the site was covered in the first meeting, where the designers decided they did not want to use a vault under the ground to treat runoff.

The result of the team's collaboration is a project where vegetated stormwater features are integrated naturally and beautifully into the fabric of the site, at a reduced cost to the property owner. The residents love living here, the owner is very proud of this project, and the design team is sharing the positive experience with colleagues and applying the techniques to other projects. Local community leaders and the State and Regional Water Boards are touting Colonia San Martin as a model of success for other infill development in the region. The project was the recipient of the California Stormwater Quality Association's 2009 Sustainable Stormwater Project Award.

Colonia San Martin Mercy Housing Project. (Credit: Quadriga)

3.3 RECOMMENDED TOOLS FOR PLANNING, SELECTING AND DESIGNING LID STRATEGIES

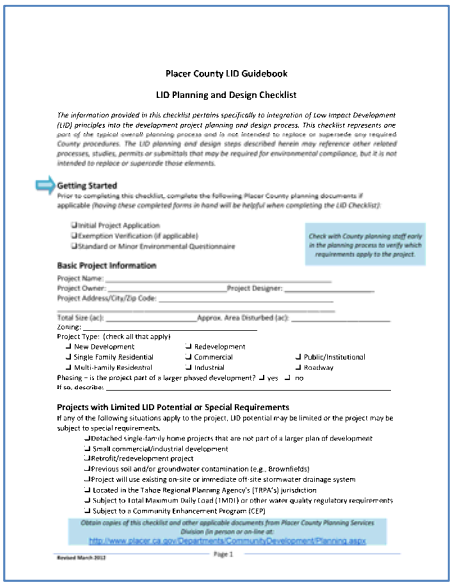
Various tools have been developed for use with this Guidebook, including the planning and design checklist, selection matrix, and site design and runoff management fact sheets.

LID Planning and Design Checklist

See end of Chapter 3 and Appendix F

For the ten steps shown on the process flowchart (Figure 3-1 shown previously in this chapter), the LID Planning and Design Checklist outlines questions for the planner/designer in an easy-to-use "fill in the blank" format. The checklist (located at the end of this chapter and in Appendix F) walks the project applicant through the planning and design process and helps ensure that LID is considered and integrated every step of the way. It can also serve as an educational tool for members of the design team new to LID. Additional information and instructions for completing the checklist can be found in the next section of this chapter.

Ideally, the completed checklist should be submitted to the permitting agency along with the design plans, calculations and other background documentation, to help educate and inform the planners and streamline the review process.



Placer County LID Guidebook

LID Planning and Design Checklist

The information provided in this checklist pertains specifically to integration of Low Impact Development (LID) principles into the development project planning and design process. This checklist represents one part of the typical overall planning process and is not intended to replace or supersede any required County procedures. The LID planning and design steps described herein may reference other related processes, studies, permits or submittals that may be required for environmental compliance, but it is not intended to replace or supercede those elements.

Getting Started

Prior to completing this checklist, complete the following Placer County planning documents if applicable (having these completed forms in hand will be helpful when completing the LID Checklist):

- ❑ Initial Project Application
- ❑ Exemption Verification (if applicable)
- ❑ Standard or Minor Environmental Questionnaire

Check with County planning staff early in the planning process to verify which requirements apply to the project.

Basic Project Information

Project Name: _____

Project Owner: _____ Project Designer: _____

Project Address/City/Zip Code: _____

Total Size (ac): _____ Approx. Area Disturbed (ac): _____

Zoning: _____

Project Type: (check all that apply)

- ❑ New Development
- ❑ Redevelopment
- ❑ Single Family Residential
- ❑ Commercial
- ❑ Public/Institutional
- ❑ Multi-Family Residential
- ❑ Industrial
- ❑ Roadway

Phasing – is the project part of a larger phased development? ❑ yes ❑ no

If so, describe: _____

Projects with Limited LID Potential or Special Requirements

If any of the following situations apply to the project, LID potential may be limited or the project may be subject to special requirements.

- ❑ Detached single-family home projects that are not part of a larger plan of development
- ❑ Small commercial/industrial development
- ❑ Retrofit/redevelopment project
- ❑ Previous soil and/or groundwater contamination (e.g., Brownfields)
- ❑ Project will use existing on-site or immediate off-site stormwater drainage system
- ❑ Located in the Tahoe Regional Planning Agency's (TRPA's) jurisdiction
- ❑ Subject to Total Maximum Daily Load (TMDL) or other water quality regulatory requirements
- ❑ Subject to a Community Enhancement Program (CEP)

Obtain copies of this checklist and other applicable documents from Placer County Planning Services Division (in person or on-line at:
http://www.placer.ca.gov/Departments/CommunityDevelopment/Planning.aspx

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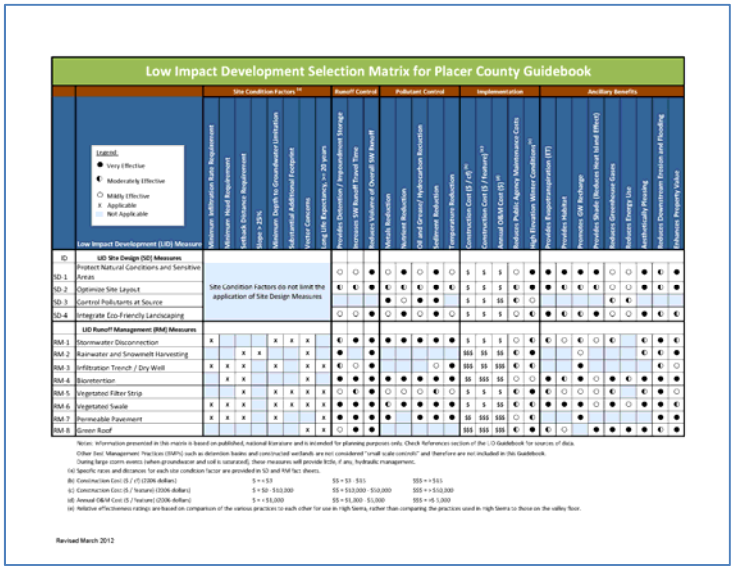
The LID Planning and Design Checklist is included at the end of Chapter 3 and In Appendix F.

LID Selection Matrix

See Figure 4-1 in Chapter 4 and Appendix F

The LID Selection Matrix (located in Chapter 4 and Appendix F) provides guidance for selecting the appropriate mix of LID site design practices and techniques for the project considering site condition factors, LID measure performance goals (runoff management and pollutant control), implementation concerns (e.g., costs and maintenance needs), and ancillary benefits (e.g., provides habitat, improves air quality). For each of the 12 features, design criteria are provided and relative ratings are given for performance, costs, and ancillary benefits.



Low Impact Development Selection Matrix for Placer County Guidebook

Legend:
● Very Effective
◐ Moderately Effective
○ Mildly Effective
x Applicable
Not Applicable

ID	Low Impact Development (LID) Measure	Site Condition Factors[1a]						Runoff Control		Pollutant Control				Implementation				Ancillary Benefits								
		Minimum Infiltration Rate Requirement	Minimum Head Requirement	Setback Distance Requirement	Slope > 25%	Minimum Depth to Groundwater Limitation	Adjacent & Additional Incompatibility	Vector Concerns	Long Life Expectancy, >= 20 years	Provides Detention / Impoundment Storage	Increases SW Runoff Travel Time	Reduces Volume of Overall SW Runoff	Metals Reduction	Nutrient Reduction	Oil and Grease/ Hydrocarbon Reduction	Sediment Reduction	Temperature Reduction	Construction Cost ($ / sf)[1b]	Construction Cost ($ / Feature)[1c]	Annual O&M Cost ($)[1d]	Reduces Public Agency Maintenance Costs	High Flexibility Winter Conditions[1e]	Provides Evapotranspiration (ET)	Provides Habitat	Promotes GW Recharge	Provides Whole (Reduces Heat Island Effect)	Reduces Greenhouse Gases	Reduces Energy Use	Aesthetically Pleasing	Reduces Downstream Erosion and Flooding	Enhances Property Value
ID	**LID Site Design (SD) Measures**																													
SD-1	Protect Natural Conditions and Sensitive Areas	Site Condition Factors do not limit the application of Site Design Measures								○	○	●	○	●	○	●	○	$	$	$	○	●	●	●	●	●	○	○	●	◐	●
SD-2	Optimize Site Layout									◐	◐	●	◐	◐	◐	●	◐	$	$	$	◐	●	●	◐	◐	◐	○	○	●	◐	●
SD-3	Control Pollutants at Source												●	○	●	●		$	$	$$	◐	○					◐	◐			
SD-4	Integrate Eco-Friendly Landscaping									○	○	●	○	●	○	●	○	$	$	$	○	◐	●	◐	◐	●	○	○	●	◐	◐
	LID Runoff Management (RM) Measures																													
RM-1	Stormwater Disconnection	x				x	x	x		◐	●	●	●	●	●	●	●	$	$	$	○	◐	◐	○	◐	○	◐		◐	●	◐
RM-2	Rainwater and Snowmelt Harvesting			x	x			x		●		●						$$$	$$	$$	◐	●			○				◐	◐	●
RM-3	Infiltration Trench / Dry Well	x	x	x		x		x	x	◐	○	●				○	●	$$$	$$	$$$	◐	◐			●					◐	○
RM-4	Bioretention		x	x				x		●	●	●	●	●	●	●	●	$$	$$$	$$	○	○	●	◐	●	○	●	◐	●	●	●
RM-5	Vegetated Filter Strip			x		x	x	x	x	○	◐	●	○	○	○	◐	○	$	$	$	◐	●	◐	○	○	○	◐		●	◐	○
RM-6	Vegetated Swale	x	x	x		x	x	x	x	●	●	●	◐	●	●	●	●	$	$	$$	◐	◐	●	●	●	○	●	○	●	●	◐
RM-7	Permeable Pavement	x	x	x		x			x	●	●	●	●		●	●	●	$$	$$$	$$$	○	◐			●					●	●
RM-8	Green Roof							x	x	○	●	●						$$$	$$$	$$$	◐	●	◐	○		●	●	●	●	◐	●

Notes: Information presented in this matrix is based on published, national literature and is intended for planning purposes only. Check References section of the LID Guidebook for sources of data.

Other Best Management Practices (BMPs) such as detention basins and constructed wetlands are not considered "small scale controls" and therefore are not included in this Guidebook.

During large storm events (when groundwater and soil is saturated), these measures will provide little, if any, hydraulic management.

(4) Specific notes and dicances for each site condition factor are provided in SD and RM fact sheets.

(b) Construction Cost ($ / sf) (2006 dollars): $ = < $3 $$ = $3 - $15 $$$ = > $15

(c) Construction Cost ($ / feature) (2006 dollars): $ = < $10 - $10,000 $$ = $10,000 - $10,000 $$$ = > $10,000

(d) Annual O&M Cost ($ / feature) (2006 dollars): $ = < $1,000 $$ = $1,000 - $1,000 $$$ = > $1,000

(e) Relative effectiveness ratings are based on comparison of the various practices to each other for use in High Sierra, rather than comparing the practices used in High Sierra to those on the valley floor.

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The LID Selection Matrix is included in Chapter 4 and In Appendix F

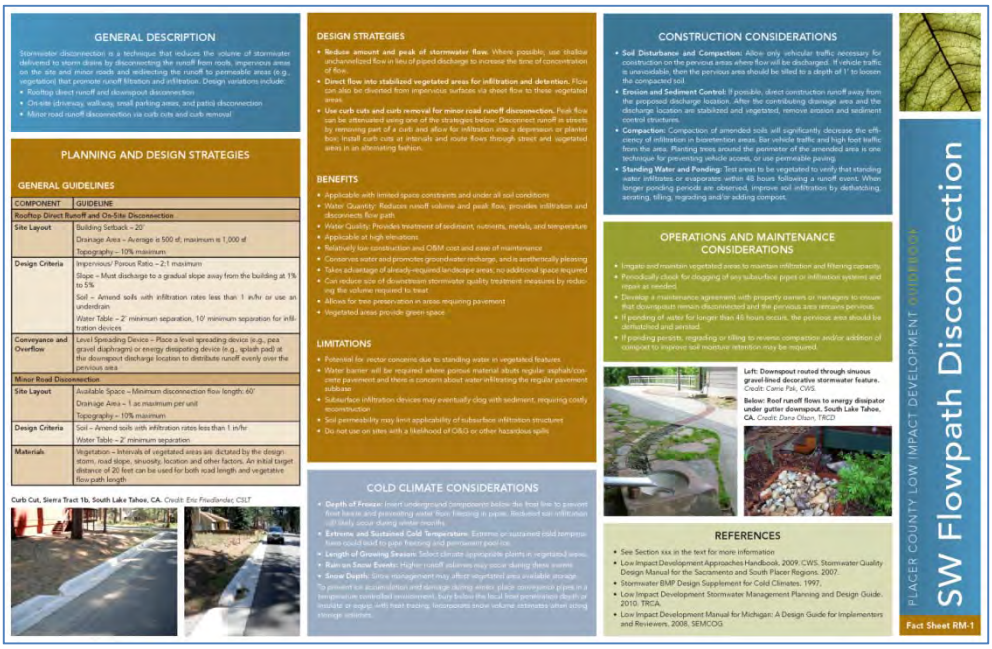
LID Measure Fact Sheets

See end of Chapter 4 and Appendix F

Fact sheets for the 12 recommended LID measures are provided at the end of Chapter 4 and repeated again in Appendix F for easy access. Four Site Design (SD) measures relate to design and layout of the site and are mostly non-structural in nature, therefore tend to be the least expensive to implement. Eight Runoff Management (RM) measures are more structural in nature and entail installation of physical components on the site. Projects utilizing as many Site Design measures as possible are more likely to require less of the Runoff Management measures.

These tools provide guidance for incorporating LID into development projects in the High Sierra areas of Placer County, but can be used as guidance for planning and designing projects in other areas of the county as well. They have been designed for stand-alone and "at a glance" use by practitioners familiar with LID, based on an understanding of the background concepts and information discussed in this Guidebook.

Example of Site Design (SD) Fact Sheet (included in Chapter 4 and Appendix F)



Example of a Runoff Management (RM) Fact Sheet (included in Chapter 4 and Appendix F)

3.4 ADDITIONAL INFORMATION AND INSTRUCTIONS FOR COMPLETING THE LID PLANNING AND DESIGN CHECKLIST TOOL

This section is a supplement to the basic information and questions contained in the LID Planning and Design Checklist at the end of this chapter. It is intended to provide additional background information and examples and should be used side-by-side with the checklist, particularly by first-time users of this Guidebook and those new to LID planning and design.

Step 1 – Identify Stormwater Management/LID Project Goals

Often, property owners and/or design team members have an idea of the desired goals for stormwater management for the project from the outset. Nearly all projects are required to reduce pollutants to the maximum extent practicable, in compliance with the local stormwater quality requirements mentioned in Step 2 below. But additional goals such as flood control and runoff reduction/elimination will be determined by the site's existing or proposed drainage conditions or the size and condition of the receiving system/waterway. Also, based on the June 2011 draft NPDES Phase II permit published by the State Water Board, runoff controls (e.g., matching pre and post-project runoff for specified storm intervals) will likely become mandatory for many projects in the future.

This section of the checklist also asks the applicant to note any desired LID strategies (e.g., infiltration, detention) based on the stated goals. In some cases, site-specific information may be known before the Steps 3 and 4 inventories are performed. For example, knowing that the site has well-drained soils, the project applicant could indicate that infiltration is a desired LID strategy. For guidance in formulating project goals, the project applicant should consider the objectives included in the Placer County Phase II NPDES Permit for the Tahoe Basin:

Conserve Natural Areas: If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- *Concentrate or cluster development on portions of a site while leaving the remaining land in a natural undisturbed condition.*
- *Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.*
- *Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.*
- *Promote natural vegetation by using parking lot islands and other landscaped areas.*
- *Preserve riparian areas and wetlands.*

Step 2 – Identify and Incorporate Applicable Government Requirements

Every project will be subject to local government requirements, and some projects will also be subject to regional, state and/or federal regulations. During this step in the process, the project applicant should make a note of all known applicable requirements, policies, plans and guidelines and become familiar with the documents. Some of the requirements overlap. For example, projects moving 250 cubic yards or more of dirt will need to comply with the County's Grading, Erosion and Sediment Control Ordinance

(Placer County Code 15.48), and additionally, projects disturbing one acre or more will be required to obtain coverage under the State Water Board's Construction General Permit. The following sections provide background for some of the regulations; however, it is not a comprehensive discussion and project applicants should check with the County to confirm which requirements apply.

Water Quality Regulations Applicable to the LID Guidebook Study Area

The County has been issued various National Pollutant Discharge Elimination System (NPDES) municipal stormwater permits by the state and regional water boards that require programs and activities to reduce, to the maximum extent practicable, discharge of pollutants in stormwater and urban runoff from the County's stormwater drainage systems to receiving water bodies. The County is also subject to total maximum daily load (TMDL) requirements for sediment, nitrogen and phosphorus that are designed to limit the amount of those pollutants that can be discharged daily to a particular water body. The stormwater permits and TMDLs apply to different areas of the county, as follows (also see the map in Figure 3-2):

The Middle Truckee River Watershed

Placer County and the Town of Truckee (located in Nevada County) are covered by the State's Phase II NPDES general permit (for small municipal separate storm sewer systems [MS4]) in this watershed. The watershed includes the sub-sheds for Martis Creek, Squaw Creek, and Bear Creek (and others) (See Figure 3-3). The two agencies have developed stormwater management plans to describe programs and best management practices (BMPs) that they are implementing to comply with the permits. This includes establishing and enforcing requirements for new and redevelopment projects to control sources of pollution and treat stormwater runoff. LID is encouraged, but not currently required, for development projects in the Truckee River Watershed, but LID may be mandated in the future due to anticipated new requirements in the new Phase II permit to be adopted by the State in 2012. For more information on the County's Stormwater Quality Program and stormwater management requirements for development projects, see: http://www.placer.ca.gov/Departments/Works/StrmWtr/StrmWtrAbout.aspx and http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/final_sm_ms4_fact_order.pdf.

In addition, sediment TMDLs were adopted by the Lahontan Regional Water Quality Control Board for Squaw Creek and the Truckee River in 2006 and 2008, respectively. The State established the TMDLs on the basis that flow events resulting from thunderstorms, snow melt and dam releases, as well as population growth and urbanization, produce turbidity spikes that exceed the State's water quality objective for Squaw Creek and Truckee River that have impacted the in-stream aquatic beneficial uses of the receiving waters. The TMDLs establish annual/daily sediment loading capacities and reduction targets to be attained over a period of 20 years. Compliance with the TMDLs requires implementation of management practices to control erosion and limit sedimentation (e.g., reducing sediment loadings from winter road sanding operations), and application of LID principles and practices in the Truckee River Watershed will also play an important role in helping to achieve compliance. For more information on the TMDL programs, see: http://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/

NPDES Storm Water Permit Areas in Placer County

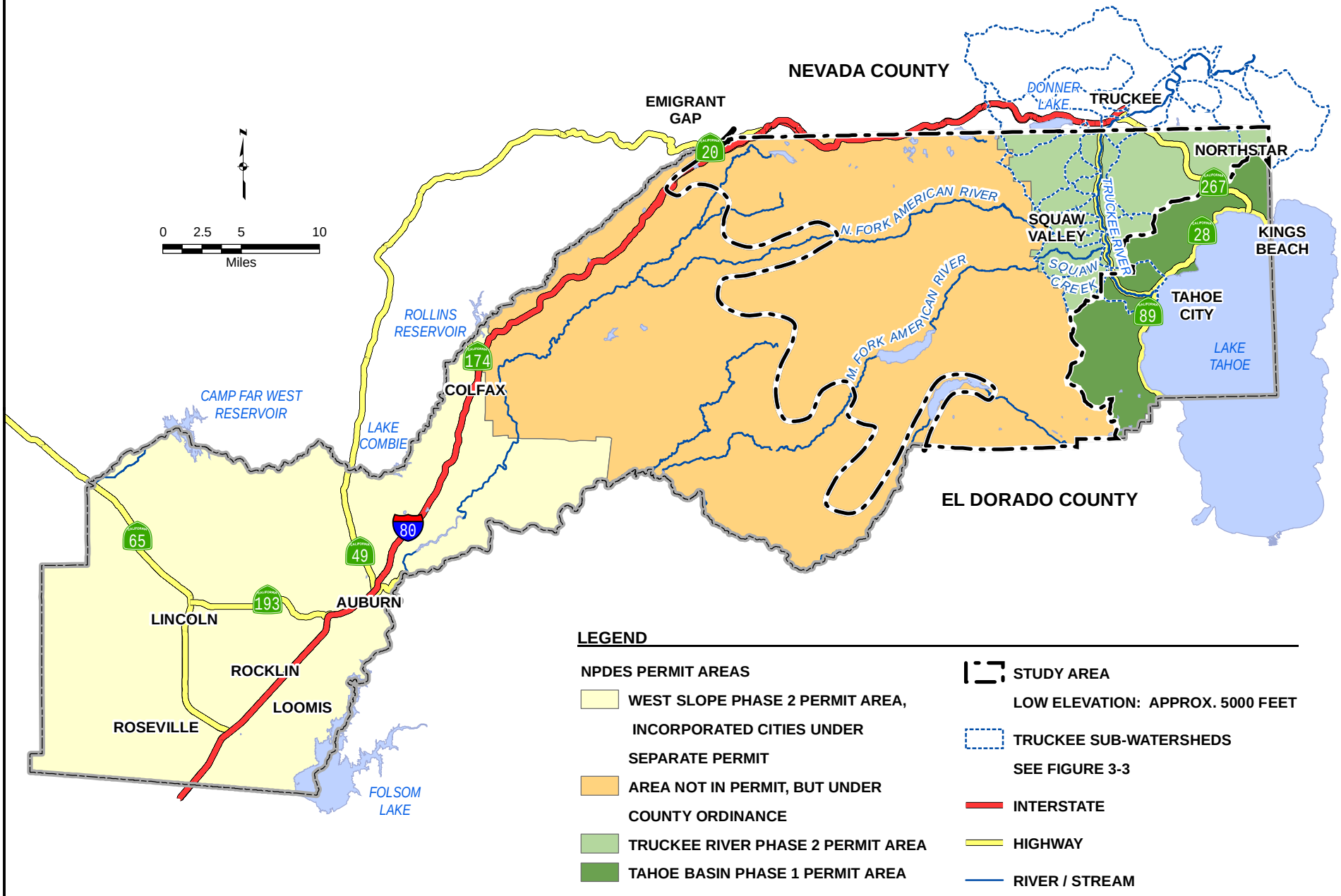


Figure 3-2

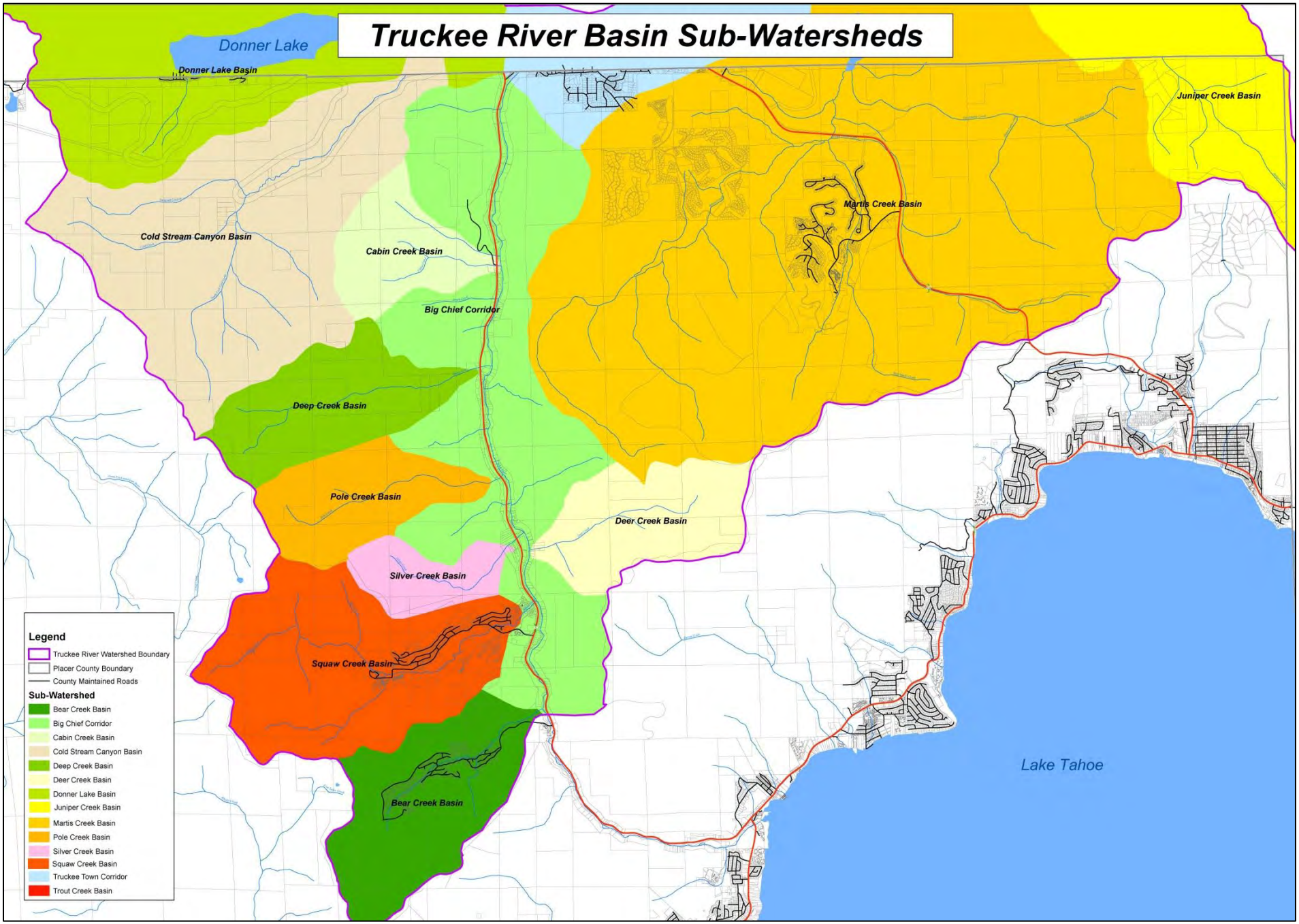

Truckee River Basin Sub-Watersheds
Donner Lake
Donner Lake Basin
Juniper Creek Basin
Martis Creek Basin
Cold Stream Canyon Basin
Cabin Creek Basin
Big Chief Corridor
Deep Creek Basin
Pole Creek Basin
Deer Creek Basin
Silver Creek Basin
Squaw Creek Basin
Bear Creek Basin
Lake Tahoe
Legend
Truckee River Watershed Boundary
Placer County Boundary
County Maintained Roads
Sub-Watershed
Bear Creek Basin
Big Chief Corridor
Cabin Creek Basin
Cold Stream Canyon Basin
Deep Creek Basin
Deer Creek Basin
Donner Lake Basin
Juniper Creek Basin
Martis Creek Basin
Pole Creek Basin
Silver Creek Basin
Squaw Creek Basin
Truckee Town Corridor
Trout Creek Basin

Figure 3-3

Unincorporated County Area Between 5,000 ft Elevation and Donner Summit

The portion of the Guidebook project area above the 5,000 ft elevation level (near Blue Canyon-Nyack Airport) and below Donner Summit and outside the Truckee River Watershed (see Figure 3-2) is not covered by an NPDES permit due to low population and minimal growth potential, and the County does not anticipate any near-term mandate for LID implementation. But since the County uniformly enforces stormwater requirements for development projects throughout the county, development projects in this area are required to implement stormwater source and treatment controls to reduce pollutants in site runoff, and LID is encouraged. Should the updated NPDES Phase II permit mandate LID implementation within permitted areas, the County may modify its stormwater regulations to incorporate such requirements on a county-wide basis. See the County's web site for the stormwater requirements: (http://www.placer.ca.gov/Departments/Works/StrmWtr/StrmWtrAbout.aspx)

Water Quality Regulations Applicable Outside the Guidebook Study Area

The remaining areas of the county not described above include a portion of the Tahoe Basin and the areas below 5,000 ft elevation (see Figure 3-2). Although this Guidebook does not specifically address those areas, the County encourages the application of the LID principles and practices in the Guidebook throughout the County as long as they do not conflict with other requirements. The following is a brief synopsis of the water quality regulations that apply in those other areas.

The Tahoe Basin

Placer County is an NPDES Phase I co-permittee with South Lake Tahoe and El Dorado County in the Tahoe Basin (see Figure 3-2). The permit was renewed in 2011 to incorporate TMDLs for fine sediment, nitrogen, and phosphorous adopted by the Lahontan Regional Water Board in 2010. The co-permittees are required to implement stormwater management plans and pollution load reduction plans to achieve compliance with both the stormwater permit and the TMDL and protect the beneficial uses of Lake Tahoe. Due to declining clarity of the lake and its status as a protected national resource, the stormwater requirements for development projects in the Lake Tahoe Basin are more stringent than elsewhere in the County. The Tahoe Regional Planning Agency (TRPA) regulates new and redevelopment in the basin, and they work closely with the Lahontan Regional Water Quality Control Board to insure that development-related water quality impacts are avoided. A basic requirement is the on-site retention of the 20 year/1 hour design storm total runoff volume from impervious areas. TRPA also regulates allowable impervious coverage. Both of these concepts are consistent with the LID principles discussed in this Guidebook. In addition to fine sediment, pollutants of concern in the Tahoe Basin include total nitrogen, total phosphate, total iron, turbidity, and oil and grease and suspended sediment. Additional information can be found on the TRPA web site: http://www.trpa.org/ and at the Lahontan Regional Water Board web site: http://www.waterboards.ca.gov/lahontan/.

West Placer County (from 5,000 ft Elevation to Sutter County)

The County is covered by the Phase II NPDES municipal stormwater general permit in the western, lower elevation portions of the county (generally from Colfax and Foresthill, southerly and westerly) in which the majority of the County's population resides (see Figure 3-2). The County has developed a stormwater management plan to describe programs and best management practices (BMPs) implemented to comply with the permit. This includes establishing and enforcing requirements for new and redevelopment projects to control sources of pollution and treat stormwater runoff. LID is encouraged, but not currently required, for development projects in this area, but LID may be mandated in the future due to anticipated new requirements in the new Phase II permit to be adopted by the State in 2012. See the County's web site for the stormwater requirements:
(http://www.placer.ca.gov/Departments/Works/StrmWtr/StrmWtrAbout.aspx)

Step 3 – Conduct Site Watershed Inventory

Eleven questions are included on the checklist to guide the project applicant through a relatively quick inventory of the watershed in which the site is located. This step is not intended to be a comprehensive watershed characterization or assessment and no field data will be collected, although a field visit is recommended to confirm findings from review of aerial photographs, maps and written documentation. The goal of the inventory is to gather information about the surrounding watershed, neighboring properties upstream and downstream, and downstream receiving waters for the property. It is critical to plan for and design the drainage system to handle any run-on to the property, and to be familiar with any water quality, drainage or other environmental requirements or limitations posed by the downstream land areas or receiving system to which the project will deliver runoff. Such conditions could affect design of the LID features for the project.

Step 4 – Conduct Site Inventory and Evaluation

Conducting the site investigation prior to creating the LID design is the most significant step in the planning process and three pages of the checklist are dedicated to this task. This section of the checklist is intended to be completed in conjunction with a site visit and it guides the project applicant through questions about physical site conditions, potential barriers to using LID and an opportunities analysis, all of which will help create the site design plans and identify the most appropriate LID features for the project.

Planning for LID communities relies on the performance of a thorough site analysis. Site planners can use the information gathered during the site analysis to create the best balance between development and the conservation of natural resources. By identifying buildable and nonbuildable areas of a site, planners can direct development into areas that will experience the least impacts on air, soil, and water.

-National Association of Home Builders Research Center, 2003

Physical Site Constraints and Opportunities

This section describes various physical site constraints and opportunities that should be identified before the work of laying out the site design begins; this information may already be available in existing environmental and engineering studies for the surrounding area, other projects in the vicinity of the site, or the site itself:

- Existing lot lines, lease areas and easements
- Proposed lot lines, lease areas, and easements
- Soils, including infiltration capacity and soil quality (contamination)
- Topography/slopes
- Hydrologic (surface water) features, including seeps, springs, closed depression areas, drainage swales, and contours
- Climate/precipitation patterns
- Groundwater depth and quality
- Vegetation, including riparian zones, habitat and overhead foliage/trees
- Utilities: stormwater/drainage and other underground utilities; overhead utilities
- Space Constraints/Configuration
- Cultural features (could affect site footprint and placement of LID facilities)

Site constraints can be identified by looking at the site topography, soils, groundwater mapping, flood mapping, sensitive features, unique features, etc. The goal of this evaluation is to determine, for example, if any of the following are present: soils with high or low infiltration rates, slopes greater than 25%, or shallow depth to groundwater. Site opportunities can also be identified by looking at the site features. The goal of this evaluation is to determine, for example, if any of the following are present: riparian areas, natural swale areas, soils with good infiltration rates, or existing impervious surfaces that can be converted to pervious. A more complete list of opportunities and constraints is provided in the checklist. Identifying and evaluating these site features will enable the designer to creatively explore which LID techniques can be incorporated into the design.

> Realizing LID's full benefits requires the use of innovative site-specific approaches to minimize impervious surfaces, reduce stormwater volume, and maintain or improve natural ecosystem functions. Not all locations can effectively utilize LID techniques. Soil permeability, slope, and water table characteristics can limit the potential for local infiltration. LID requires precise engineering for soil characteristics, filtration rates, water tables, native vegetation, and other site features. The most reliable source of information with regard to any particular site is an experienced stormwater/LID management engineer. Such engineers have gained knowledge from experience to identify the hidden benefits, those difficult to quantify, and what works best for site-specific situations.
>
> -LMI, 2005

Soils

Soil types will determine which LID techniques are feasible and appropriate for the project site. Soils that typically have adequate drainage and permeability (Soil Types A, B) are typically appropriate for infiltration-type LID techniques, while soils with poor drainage and permeability (Soil Types C, D) are either not appropriate for infiltration, or will require additional design modifications to adapt to local soil conditions (such modifications are discussed in the LID fact sheets in Chapter 4). The National Resource Conservation Service (NRCS) (http://www.nrcs.usda.gov/) provides soils maps for most project areas, and some of these maps are available online (e.g., Soil Survey of the Tahoe Basin Area, California and Nevada). Additional soil investigations are typically necessary to inform the design process. Hydrologic soil group information should be used for preliminary siting studies only. Site specific soil testing, by a qualified civil or geotechnical engineer, is recommended before preliminary and final design and implementation of LID projects to confirm soil properties including infiltration capacity and should be done as early in the design process as possible.

Topography

The topography of the site defines both the location and capacity requirements for potential LID implementations (LID Center, 2010). Typically, LID practices are easier to implement where adequate grade exists at the site. However, the steeper the slope, the more likely soil erosion or slides could occur. Generally, slopes greater than 25% should be avoided for clearing, grading and building. Steep slopes and slide prone areas are not advisable for infiltration LID techniques.

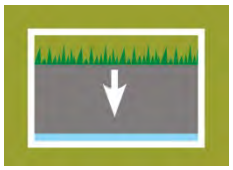
The topography of upstream and downstream sites should also be considered with respect to any potential contribution to the total runoff generated during a storm event. Designing effective LID into new or existing sites requires a careful analysis of the topography and how and where stormwater runoff will concentrate and flow. Site assessment of the pre-developed site during a storm event is highly recommended to observe and map areas of natural infiltration, concentration, flow and site discharge points. For redevelopment projects, the record drawings from the previous construction will be important. In the event that topographic data does not already exist for the site or the accuracy of pre-existing data is questioned, a topographic survey should be ordered prior to proceeding with the design phase of the project. The survey should produce a detailed site topographic map showing the smallest contour interval possible (1-foot contour intervals are preferred, but if not available, additional intervals can be interpolated from maps with larger intervals.)

Hydrologic Features

The following hydrologic features should be assessed during the site inventory:

- *Precipitation:* Precipitation patterns will often provide information that will inform the LID design. Rainfall events, snowfall events, or rain on snow events will often yield different runoff conditions varying on precipitation intensity, duration, and type. These patterns should be studied at the project area, but will likely reflect local conditions of the general area.
- *Onsite streams and other water bodies*: Water bodies should be delineated for the project site, to make use of existing drainage patterns to the extent practical. Working with the site's flow patterns may reduce grading and associated costs.
- *Floodplains and drainage hazards:* Floodplains on the site should be delineated to identify areas where significant flooding may occur. LID techniques generally target control of runoff during low stormwater flow events and are ineffective during high events, and therefore can sometimes be located within floodplain areas. Also, other areas of the site with potential drainage hazards should be identified.
- *Onsite drainage area*: Overall size of the drainage area within the project site should be identified to determine how many LID facilities maybe needed, and if the drainage area needs to be subdivided into smaller drainage areas for design purposes. *(Note, factors such as the location, quality and regulatory status of upstream and downstream drainage areas/receiving waters were considered in Step 3).*

Much of this information may be available from the County or other agencies. Existing flow paths and upslope drainage concerns can be assessed by examining topographic maps of the site, but one of the best ways to get a sense of how water moves on the site is to visit during a heavy rain, taking note of how and where water moves across the site. Where data is not available, on-site testing/mapping by a qualified professional is recommended.



Groundwater Features

The depth to groundwater at a site will dictate whether or not certain LID measures (e.g., infiltration trench) will be feasible. The shallower the depth to groundwater, the less likely that an infiltration or bioretention technique will be able to handle runoff because the soils will already be saturated or the amount of water that can be infiltrated will be minimal. Information on depth to groundwater can be found in the Natural Resources Conservation Service (NRCS) Web Soil Survey.

Vegetation and Habitat

The type and extent of existing vegetation in the area (including riparian zones adjacent to creeks and other water features) will provide a foundation for the project design. If the site has been previously undisturbed, substantial vegetation may be present on the site. Typically, sustainable design would recommend preserving natural vegetation to the extent practicable. What also must come into consideration is the quality of existing vegetation. If the existing site has native vegetation, then this vegetation should be preserved. However, if invasive species are dominant at the site, this vegetation should not be preserved. If a site has previously been disturbed, little or no native vegetation may be present at the site. The general rule-of-thumb for design purposes is to preserve and/or enhance the quality of the existing vegetation.

Assess the quality of the habitat on the site and identify any sensitive species. Species of concern may limit vegetation removal, and limit or increase the amount of open channel conveyance within a site.

Utilities

Sites undergoing redevelopment will likely have existing utilities, including stormwater conveyance/ detention, sanitary sewer collection, and aboveground or overhead electrical, gas and/or communications lines. Making use of the existing connections to storm drainage systems when possible will reduce cost and design complexity and often save money, but the LID approach encourages use of aboveground vegetated features rather than convention piped systems. Locations of the utilities, whether below ground or overhead, should be noted on the site plan because they may pose conflicts for locating LID features. When the new site design involves adding trees to the site landscape, every effort should be made to select the most appropriate species and provide adequate clearance from buildings and overhead lines to promote a full, mature canopy that will provide air and water quality benefits and cool surfaces and runoff.

Space Constraints/Configuration

For some sites, particularly those that were previously developed or destined for densities of 90-100% imperviousness (e.g., medium to high density residential, commercial, industrial or transportation-related land uses), it is critical to ensure early in the planning process the most appropriate type of LID for the application and that adequate space is available. Other communities have had success effectively integrating LID into dense urban redevelopment sites (see City of Emeryville case study described in Chapter 2).

Understanding Climatic, Hydrologic Cycle and Soil Conditions in the Placer County High Sierra Region

In LID site design, it is necessary to understand and evaluate the local climatic, hydrologic cycle and soil conditions in order to maintain or mimic the natural hydrologic function of a site. There is not one concise description of the conditions because the Guidebook study area is comprised of various areas (see Figure 3-2). Rather, the following information (based on published data for the Truckee area) provides general information that may be useful for initial planning purposes. However; due to the wide environmental variability in the region, this information is no substitute for the more detailed, site specific investigations that are necessary to support site design.

The High Sierra region of Placer County includes the Donner Summit area, the Town of Truckee and portions of the Lake Tahoe Basin. Although these areas do share many similarities in terms of climatic, hydrologic and soil conditions, there are also some important differences among these regions. For example, the Donner Summit area often receives the largest amounts of annual snowfall nationally, while portions of eastern Truckee, just a small distance to the east, are impacted by a rain shadow that creates almost a high desert type environment. Large spatial temperature differences provide another good example of the climatic variation within the region. Each year, the Town of Truckee often registers the lowest daily temperature in the nation, while the surrounding areas, higher in elevation, or closer to Lake Tahoe, experience much milder temperatures due to temperature inversions and the moderating effect of the Lake's large water volume.

Hydrologic Cycle in the High Sierra Region of Placer County

The cold winter climate above 5,000 feet brings significant snowfall and snow retention during the winter months, therefore the timing for the hydrologic cycle/process is different than other parts of the state and LID features perform differently than elsewhere. For example, vegetated bioswales and medians in parking lots and along roads can be filled with accumulated snow for 3-4 months of the year. Although there is no vegetative uptake, absorption or transpiration occurring during this period, there is natural runoff reduction at work. As the weather warms and the snow melts, the LID features will infiltrate and absorb a good deal of the snowmelt.

Climate, Precipitation and Soils Data for the Truckee Area[2]

Temperature

The Truckee area is located within a climate 'island' that encompasses the southern Cascade and Sierra mountain ranges and is characterized as humid-continental. The climate experiences relatively large changes in temperature and precipitation throughout the year (Lutgens et al, 1979). The National Weather Service reports that January is the coldest month with an average maximum temperature of 40.9 °F (4.9 °C) and an average minimum temperature of 16.3 °F (-8.7 °C). The record minimum temperature of -23 °F (-30.6 °C) was on February 27, 1962. Annually, there are an average of 228.4 days with lows of 32 °F (0 °C) or lower and 6.0 days with lows of 0 °F (-17.8 °C) or lower. Freezing temperatures have been observed in every month of the year.

[2] Climatic information for the Truckee area in the Guidebook study area is presented as an example. This should be used as a planning guide only; project applicants should conduct site-specific assessments to verify conditions applicable to the site.

Rainfall

In Truckee, for the period between 1971-2000, the mean annual precipitation was almost 31 inches, varying from about 16 inches (1976) to almost 55 inches (1996).Typically, about 75 percent of the precipitation occurs during the winter and spring (December to May) (WRCC, 2007). The average annual snowfall amounts to almost 204 inches; with a high occurring in 1952 of just over 401 inches of snow.[3]

Geology and Soils

The Town of Truckee is located in the northern portion of the Sierra geologic province. The northern Sierra Nevada mountain range is subdivided into three main geologic complexes which are regions of distinct rock types, topography, and structure that were defined by the primary mountain building episodes of the Sierra Nevada Range. The Truckee Basin, in which the Town of Truckee is located, lies within the eastern most complex of the Sierra Nevada range. The basin is located between two north-trending mountain ranges, the 9,000-foot-high Sierra Nevada on the west and the 10,000-foot-high Carson Range on the east.

The bedrock of the Truckee Basin is primarily defined by metamorphic rock and includes granite intrusions associated with the Sierra Nevada range. These rocks are consolidated, very dense and hard, with small grain structure and little capacity for water storage. On top of the bedrock are volcanic flows, glacial deposits, and stream and lake deposits. The structure of the deposits is nearly horizontal beds of mostly unconsolidated volcanic material and sedimentary material. Sedimentary material is generally very porous and stores large amounts of ground water.

Much of the soil underlying the Town of Truckee consists of glacial till, moraines and outwash. These soils, which can be described as silty/sandy gravels or gravelly/silty sands contain large quantities of sediments that were transported to the Truckee Basin from the crest of the Sierra Nevada by glacial activity. Past glacial activity has also resulted in the deposition of cobbles and boulders in the Basin. Soil depths typically range from 20 to 60 inches.

Vegetation

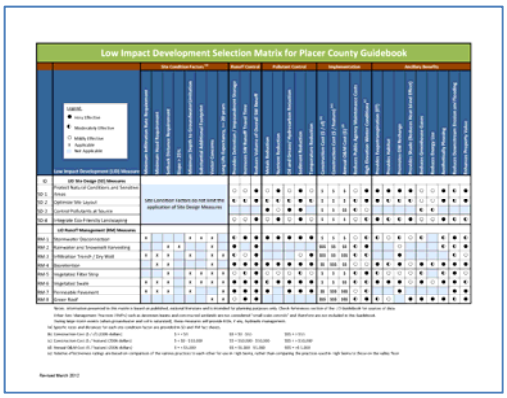
Plant communities in the Truckee River Watershed include mixed conifer forest, Great Basin sage scrub, and alpine meadows of grasses and wildflowers. Peaks are generally barren. Riparian vegetation of cottonwood, aspen, dogwood, willow, sedges and grasses grow along the river edges. (TRWC, 2012).

[3] Snow water content varies based on crystal structure, wind speed, temperature, etc. Ten (10) inches of snow contains between 0.10 and 4.0 inches of water, but average U.S. snow fall varies between one inch of water for every 10-4 inches of snowfall.

Step 5 – Attend Pre-Development Meeting/Submit Initial Application

The checklist provides guidance to the project applicant about what information to gather, compile and summarize to prepare for the pre-development meeting with the County, as well as additional agencies that must be contacted related to the LID design, such as the fire district. This is the point at which the applicant should re-evaluate the original stormwater management/LID goals documented in Step 1 and adjust them if needed.

Step 6 – Perform Initial LID Selection (use LID Selection Matrix)



This step in the process involves use of the LID Selection Matrix (see Figure 4-1 in next chapter) along with the Site Design (SD) and Runoff Management (RM) fact sheets (also included in Chapter 4), to make the initial selection of LID measures appropriate for the project. As indicated on the LID selection matrix, there are various types of factors which will influence and/or determine the selection of LID measures for the project, described as follows:

- **Site Condition Factors** – Factors such as the infiltration rate, setback distance, and topographic slope (data collected in Step 4) will dictate the type of LID appropriate for the project. See Chapter 4 for more details.
- **Stormwater Runoff Control** –SD and RM measures will provide varied amounts of detention storage, increased stormwater runoff travel time, and reduced overall volume of stormwater. See Chapter 4 for more details.
- **Pollutant Control** – SD and RM measures will provide different amounts of water quality treatment and/or pollution prevention. See Chapter 4 for more details.
- **Implementation**– As discussed in Chapter 2, it is critical to consider not only the initial costs of an LID technique, but also its projected long-term maintenance costs. Ideally, the design team should prepare a life-cycle analysis, which would include the monetized value of co-benefits (e.g., materials or energy saved) and replacement costs. The matrix provides relative comparisons of costs (low, medium and high) based on published national literature. Unfortunately, no state or local cost data is available. See Chapter 2 for more information and examples of economic benefits of LID. Designers should consider long-term maintenance needs of an LID measure before specifying it for the site and determine the likely party that will be responsible for conducting the maintenance. The property owner should be consulted during this step. In the case of a residential subdivision, consideration should be made about whether maintenance will fall to individual property owners or a homeowners' association.
- **Ancillary Benefits** – Many of the LID measures will provide additional benefits such as habitat, groundwater recharge and reduction of greenhouse gases. See Chapter 4 for more details.

Step 7 – Locate LID Measures on the Site and Create the Preliminary LID Design Plan

This step in the process entails locating the LID measures on the site plan, considering the site-specific inventory data compiled in Step 4 such as the site's unique topography, existing hydrologic features and soil infiltration rates. Also, the specifications noted in the LID measure fact sheets in Chapter 4 will help determine the size of the area needed for a particular measure and the maximum contributing drainage area for that measure. Several LID measures can be used in combination or the site can be broken up into smaller drainage sheds to satisfy the design criteria.

The site design should distribute the LID measures appropriately on the project site and connect them to on-site and/or off-site stormwater drainage systems or natural waterways, as shown in Figure 3-4. The goal should be to preserve as much valuable natural vegetation as possible, minimize disturbance and impervious surfaces on the site, and direct flow from any unavoidable impervious areas (e.g., roof downspouts) to vegetated areas for filtration and infiltration or to rainwater harvesting devices.

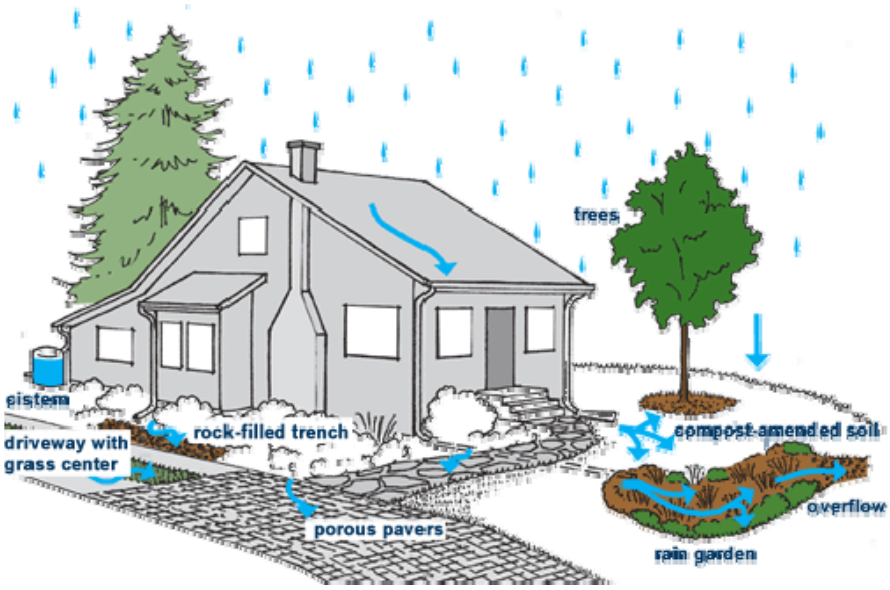


Figure 3-4. Combination of LID measures distributed on a project site

(Source: Seattle Public Utilities Residential Rainwise Program)

This is the stage in the process where the designer should look for multi-purpose opportunities, such as integrating the stormwater management functions into required landscaping areas (based on local codes), satisfying "art in public spaces" requirements with stormwater features, or installing stormwater detention (e.g., cisterns) under permeable pavement. Appendix B contains example site plans which incorporate LID into the proposed Homewood Project expansion in the Lake Tahoe Basin.

Step 8 – Design/Size the LID Measures

Performing the engineering design to size the structural LID components will likely be an iterative process. The designer will calculate the size of the feature based on the expected volume/flow of runoff and the available space on the site. The LID measure fact sheets in Chapter 4 provide the general specifications. The County should be consulted for any additional design criteria, any variations to the data included in the fact sheets, and for any additional stormwater management requirements, so that a complimentary LID design can be developed.

LID calculation methodology and design should be consistent with Placer County's recommended or accepted design criteria for stormwater management, including volume/peak rate control, water quality treatment, and any other factors specified by the agency.

Step 9 – Refine Preliminary LID Design

Developing a stormwater management program using LID principles and practices is a dynamic process. When the preliminary LID design plan is ready, the applicant should go back to Step 1 and verify that the new design satisfies the initial project stormwater management goals. If not, the design should be further refined or possibly the goals should be re-evaluated with the project owner to make sure they are realistic and achievable.

Step 10 – Submit Project Application for Review

The final step in the process is the submittal of the application to the County for review. If the County requires revisions, the applicant will go back to Step 6 and repeat the LID selection and design process.

Example of LID Site Plan (Credit: New England Environmental Inc.)

Placer County LID Guidebook

LID Planning and Design Checklist

The information provided in this checklist pertains specifically to integration of Low Impact Development (LID) principles into the development project planning and design process. This checklist represents one part of the typical overall planning process and is not intended to replace or supersede any required County procedures. The LID planning and design steps described herein may reference other related processes, studies, permits or submittals that may be required for environmental compliance, but it is not intended to replace or supercede those elements.

Getting Started

Prior to completing this checklist, complete the following Placer County planning documents if applicable *(having these completed forms in hand will be helpful when completing the LID Checklist):*

- ❑ Initial Project Application
- ❑ Exemption Verification (if applicable)
- ❑ Standard or Minor Environmental Questionnaire

Check with County planning staff early in the planning process to verify which requirements apply to the project.

Basic Project Information

Project Name: _____

Project Owner: _____Project Designer: _____

Project Address/City/Zip Code: _____

_____

Total Size (ac): _____Approx. Area Disturbed (ac): _____

Zoning: _____

Project Type: (check all that apply)

- ❑ New Development
- ❑ Redevelopment
- ❑ Single Family Residential
- ❑ Commercial
- ❑ Public/Institutional
- ❑ Multi-Family Residential
- ❑ Industrial
- ❑ Roadway

Phasing – is the project part of a larger phased development? ❑ yes ❑ no

If so, describe: _____

Projects with Limited LID Potential or Special Requirements

If any of the following situations apply to the project, LID potential may be limited or the project may be subject to special requirements.

- ❑ Detached single-family home projects that are not part of a larger plan of development
- ❑ Small commercial/industrial development
- ❑ Retrofit/redevelopment project
- ❑ Previous soil and/or groundwater contamination (e.g., Brownfields)
- ❑ Project will use existing on-site or immediate off-site stormwater drainage system
- ❑ Located in the Tahoe Regional Planning Agency's (TRPA's) jurisdiction
- ❑ Subject to Total Maximum Daily Load (TMDL) or other water quality regulatory requirements
- ❑ Subject to a Community Enhancement Program (CEP)

Obtain copies of this checklist and other applicable documents from Placer County Planning Services Division (in person or on-line at:
http://www.placer.ca.gov/Departments/CommunityDevelopment/Planning.aspx

STEP 1 - Identify Stormwater Management and LID Project Goals

Step 1

Applicant Identifies Stormwater Management / LID Project Goals

What are the stormwater management goals for the proposed project?
(check all that apply)

- ❑ Improve Water Quality/Reduce Pollution in Runoff
- ❑ Flood Control/Reduce Peak Flows
- ❑ Reduce Runoff from the Site
- ❑ Eliminate Runoff from the Site (Retain on site)

If known, what are the stormwater management/LID strategies for the proposed project?
(check all that apply)

- ❑ Infiltration
- ❑ Groundwater Recharge
- ❑ Retention
- ❑ Detention
- ❑ Disconnection of Runoff from Roofs/Impervious Surfaces
- ❑ On-Site Capture and Re-Use of Rain Water
- ❑ On-Site Capture and Re-Use of Runoff
- ❑ No Stormwater Discharge From the Site
- ❑ Other: _____
- ❑ Other: _____

The types of LID strategies selected for the project will be influenced by site conditions such as soil type and slope/topography (see Step 4)

STEP 2 - Identify and Incorporate Applicable Government Requirements

Step 2

Applicant Identifies and Incorporates Applicable Government Requirements

All projects are subject to the following Placer County requirements:

- ❑ General Plan
- ❑ Zoning Ordinance
- ❑ Land Development Manual
- ❑ Stormwater Management Manual
- ❑ Placer County General Specifications
- ❑ Subdivision Ordinance (PCC 16.04)
- ❑ Street Improvement Ordinance (PCC 12.08)
- ❑ Grading, Erosion and Sediment Control Ordinance (PCC 15.48)
- ❑ Flood Damage Prevention Ordinance (PCC 15.52)

Identify the additional local land use policy documents, plans, ordinances, requirements and guidelines that are applicable to the project.
(check all that apply and provide document names)

Check with County Planning Services Division staff to verify which requirements apply to the project

- ❑ Community Plan(s): _____
- ❑ Specific Plan(s): _____
- ❑ Master Plan: _____
- ❑ Master Use Permit: _____
- ❑ Design/Landscape Guidelines: _____
- ❑ Water Conservation: _____
- ❑ Other: _____

Note: It is critical to review applicable documents checked above before proceeding with LID design. In case of conflict between other requirements and this Guidebook, the other requirements shall prevail.

Regional/State/Federal Policies, Plans, Requirements or Guidelines - List all that apply to the project:

In the event of conflict between other regulatory requirements and this Guidebook, the other requirements shall prevail.

Regional (e.g., regional land use plans, watershed plans, etc.)

- ❑ _____
- ❑ _____

State (e.g., NPDES permits, 401 certifications, fire code, integrated regional water management, Title 24 accessibility, etc.)

- ❑ _____
- ❑ _____

Federal (e.g., Section 404, Endangered Species Act, ADA)

- ❑ _____
- ❑ _____

Note: It is critical to review and understand applicable requirements listed above before proceeding with LID design. In case of conflict between other requirements and this Guidebook, the other requirements shall prevail.

STEP 3 - Conduct Site Watershed Inventory

Step 3

Applicant Conducts Site Watershed Inventory

Check the correct answer for each question and add responses if known:

Yes	No	
❑	❑	Are there natural water bodies/waterways present on the site? If yes, describe/name:_____
❑	❑	Will the project site drainage/runoff discharge to a municipal storm drain system? If yes, provide municipality name: _____
❑	❑	Will the project site discharge to off-site receiving waters (e.g., creek, stream, river, lake, wetland)? If yes, describe/name:_____ ❑ direct discharge ❑ indirect discharge
❑	❑	Is the site's receiving water a 303d listed/impaired waterway, or a tributary to such a waterway? If yes, describe:_____
❑	❑	Are there existing or planned Total Maximum Daily Loads (TMDLs) for the receiving waters? If yes, describe:_____
❑	❑	Are there any known immediate downstream flooding problems? If yes, describe:_____
❑	❑	Is there run-on from neighboring properties that must be managed on the project site? If yes, describe:_____ If yes, are there any known problems with the run-on? If yes, describe:_____
❑	❑	Is additional development anticipated for the surrounding/adjacent area that could impact future hydrologic conditions on the site? If yes, describe:_____
❑	❑	Is additional development anticipated for the surrounding/adjacent area that could lead to further opportunities (e.g., partnerships in multi-site or regional water quality or quantity controls)? If yes, describe:_____
❑	❑	Are there other issues that could affect design of stormwater management measure for the site? If yes, describe:_____ _____

The municipal storm drain system is defined as a conveyance or system of conveyances, including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains owned or operated by a state, county, city, special district, etc.

STEP 4 - Conduct Site Inventory and Evaluation

Step 4

Perform a site visit to observe physical site features and identify potential barriers and opportunities for using LID. Use this checklist to record observations and measurements and note the locations of the features on a topographic map of the project site, or the preliminary project site plan, if available.

Applicant Conducts Site Inventory and Evaluation

Note: Most LID runoff management measures are intended to manage water for small contributing drainage areas. If the site is greater than 5 acres, you will likely need to divide the site into separate drainage areas to each be served by one or more LID runoff management measures.

Identify Physical Site Conditions

Identify and note key physical site conditions on the site map/plan; for example:

- ❑ Existing lot lines, lease areas and easements
- ❑ Proposed lot lines, lease areas, and easements
- ❑ Major and minor hydrologic features, including 100-year floodplain (FEMA and/or fully developed, unmitigated floodplain), seeps, springs, closed depression areas, drainage swales, and contours.

Identify Physical Constraints/Potential Barriers to Using LID

Do any of these **physical constraints** apply to the project site? *(check all that apply and note location on the site map/plan)*

- ❑ Soils with low infiltration (e.g., clays)
- ❑ Soils with high infiltration (e.g., rocky soils, cobbles)
- ❑ Slope > 25%
- ❑ Shallow depth to groundwater (< 10 feet)
- ❑ Project within 100-year floodplain/flood hazard area
- ❑ Sensitive water features that need to be protected (e.g., wetlands)
- ❑ Existing stormwater conveyance and/or treatment facilities (on-site and off-site)
- ❑ Areas with known or suspected contaminated soils and/or groundwater
- ❑ Aquifer and wellhead protection areas on or adjacent to the site
- ❑ Power lines/major underground utilities (e.g., buried natural gas lines)
- ❑ Areas subject to high flow conditions
- ❑ Dense overhead foliage (shade considerations for vegetative growth)
- ❑ Project space constraints based on preliminary site plan (if known)
- ❑ Other: _____
- ❑ Other: _____
- ❑ Other: _____

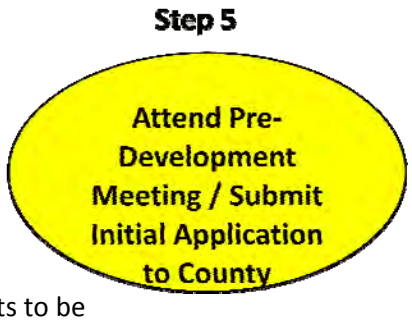
Identify Opportunities for LID

Do any of these **opportunities** apply to the project site? *(check all that apply and note location on the site map/plan)*

Feature (Existing or Proposed)	LID/Site Design Opportunities
❑ Natural vegetation and environmentally sensitive areas (areas that may support habitat)	❑ Preservation of natural pervious areas to infiltrate/filter stormwater ❑ Protect sensitive areas - during and after construction ❑ Preserve open space by clustering buildings in a smaller area ❑ Locate trash facilities away from these areas
❑ Riparian areas, natural swales, drainages, depressions	❑ Configure site to take advantage of natural site topography and avoid unnecessary cut and fill that will change the hydrologic regime ❑ Bioretention/filtration of stormwater to reduce runoff and remove pollutants ❑ Infiltration/groundwater recharge ❑ Evapotranspiration ❑ Flowpath disconnection ❑ Snow storage
❑ Soils with good/moderate infiltration capacity (e.g., NRCS Types A and B)	❑ Configure site to locate LID measures such as infiltration, bioretention and pervious pavement in areas with well-drained soils (place buildings and other impervious features in other areas of the site if possible)
❑ Exposed, bare areas	❑ Revegetation, reforestation to restore infiltration/filtration functions
❑ Existing stormwater conveyance and/or treatment facilities	❑ Analyze existing stormwater treatment facilities for potential to treat additional runoff
❑ Existing impervious areas that can be converted to pervious areas	❑ Replace with pervious/ permeable pavement (e.g., porous concrete, asphalt or paving stones) ❑ Use alternative driveways (e.g., with center strip of plants/DG, subject to fire approval)
❑ Buildings/ Lots	❑ Minimize individual lot size ❑ Concentrate/cluster uses and lots ❑ Configure lots/development to avoid sensitive natural areas and conform to natural topopgraphy ❑ Integrate stormwater management/LID with lot/building layout to mitigate impacts from buildings and other impervious surfaces ❑ Use rain barrels and/or cisterns to store rainwater for lot irrigation
❑ Rooftops	❑ Consider vegetation for rooftops, walls and adjacent areas to filter, evapotranspirate rainwater, reduce runoff and shade/insulate buildings ❑ Disconnect downspouts from piped storm drain system ❑ Route roof runoff (rainfall/snowmelt) to vegetated areas for infiltration/filtration ❑ Route roof runoff to dry wells or pervious areas for infiltration ❑ Route roof runoff to rain barrels/cisterns for storage and re-use
❑ Parking lots, sidewalks, driveways	❑ Utilize permeable pavement (with or without underdrains, depending on soil type) for pedestrian and low traffic vehicular areas such as parking and alleyways *(subject to fire approval)* ❑ Use vegetation in medians and islands within turnaround areas to

Feature (Existing or Proposed)	LID/Site Design Opportunities
❑Parking lots, sidewalks, driveways (cont'd)	infiltrate/filter stormwater (rain and snowmelt, subject to fire approval) ❑ Disconnect drives/walkways/small impervious areas to natural areas ❑Consider underground cisterns to detain water to reduce peak runoff flows or store water for re-use ❑ Use minimum standards for road width *(subject to fire approval)* ❑ Use cul-de-sacs and turnarounds at minimum standard width ❑ Use minimum standards for driveway lengths and widths ❑ Use minimum standards for parking ratios ❑ Consider shared parking potential (e.g., shared driveways) ❑ Tuck parking under buildings (tuck-under parking)
❑Green Space/ Site Landscaping/ Road and Parking Lot Medians	❑ Connect open space/sensitive areas with larger community greenways plan ❑Connect upstream features with drainage features that infiltrate, treat, and convey stormwater ❑Determine which areas are viable for snow storage ❑Disconnect runoff flow paths with vegetation wherever possible

STEP 5 - Attend Pre-Development Meeting / Submit Initial Application to County



Prior to scheduling the pre-development meeting or submitting the initial planning application to the Planning Services Division, the following tasks are recommended (check off when completed):

Review the following if available (if not available before the pre-development meeting, planning staff will ask for these types of reports to be prepared after the meeting):

- ❑ A **soils report** prepared by a licensed geotechnical engineer or licensed engineering geologist. The report shall identify infiltration capability, natural stormwater conveyance, depth to groundwater and geologic hazard areas.
- ❑ An **inventory of existing native vegetative** cover by a licensed landscape architect, arborist or qualified biologist, identifying any forest areas on the site, species and condition of ground cover and shrub layer, tree species and canopy cover.
- ❑ A **streams, wetland, and water body inventory and classification** report by a qualified biologist showing wetland and buffer boundaries, if present.
- ❑ **Stormwater best management practices plan** prepared by a licensed civil engineer.

Based on the previous steps 2-4, summarize any issues associated with:

- ❑ Hydrologic Features_____
- ❑ Soils/Grading_____
- ❑ Vegetation_____
- ❑ Wetlands_____
- ❑ Flooding _____
- ❑ Groundwater _____
- ❑ Other _____

Re-evaluate the stormwater management/LID project goals originally developed in Step 1 and adjust page 2 of the checklist as needed to reflect the site opportunities and constraints.

Check with the Planning Services Division to determine which of these agencies/groups needs to be consulted during or after meeting (*check all that apply*):

- ❑ Planning Services
- ❑ Engineering and Surveying Department
- ❑ Environmental Engineering and Utilities (Special Districts)
- ❑ Environmental Health Services
- ❑ CalFire
- ❑ Building Services
- ❑ Facility Services-Parks
- ❑ Department of Public Works

Step 6 –Perform Initial LID Selection (Use LID Selection Matrix)

Step 6

Applicant Performs Initial LID Selection (Use Matrix)

In this step in the process, use the results from the site evaluation (Step 4) to determine which LID design concepts are viable, and which concepts are not feasible for the project site. This evaluation may result in a need to revisit and revise any preliminary site design in an iterative fashion.

Iterative Process
Step 6. SELECT LID Measure
Step 7. LOCATE LID Measure
Step 8. SIZE LID Measure; if feature does not work, then go back to Step 6 to select another LID measure.

Use the LID Selection Matrix (at the end of this checklist) and the 12 associated fact sheets in Chapter 4 of the LID Guidebook to consider and initially select Site Design (SD) measures and LID Runoff Management (RM) measures for the project.

LID Site Design Measures:

Site design measures are typically non-structural and relate to the layout of the site, whereas the LID measures are structural in nature and have associated construction/installation and maintenance costs.

- SD-1: Protect Natural Conditions and Sensitive Areas
- SD-2: Optimize Site Layout
- SD-3: Control Pollutants at Source
- SD-4: Integrate Eco-Friendly Landscaping

LID Runoff Management Measures:

- LID 1: Stormwater Disconnection
- LID 2: Rainwater and Snowmelt Harvesting
- LID 3: Infiltration Trench / Dry Well
- LID 4: Bioretention
- LID 5: Vegetated Filter Strip
- LID 6: Vegetated Swale
- LID 7: Permeable Pavement
- LID 8: Green Roof

Plan ahead for short and long-term maintenance needs and identify likely responsible party to provide the maintenance, as well as funding mechanism to pay for such maintenance to ensure optimum performance *(consider consulting maintenance personnel before design is complete)*

STEP 7 – Locate the LID Measures on the Preliminary LID Design Plan

Step 7

Applicant Locates the LID Measures on the Preliminary LID Design Plan

Use the information from Steps 4, 5 and 6 to locate the LID features on the Preliminary LID Design Plan. Sketch a design concept that distributes the LID measures appropriately on the project site, including notes on how the LID measures connect to on-site and/or off-site stormwater drainage systems.

Keep these ideas in mind as you locate LID measures on the LID Design Plan:

Iterative Process
Step 6. SELECT LID Measure
Step 7. LOCATE LID Measure
Step 8. SIZE LID Measure; if feature does not work, then go back to Step 6 to select another LID measure.

- ❑ Preserve and utilize existing natural/vegetated areas as much as possible
- ❑ Minimize site disturbance, building footprints and impervious areas
- ❑ Locate new impervious features on previously disturbed areas or over areas of the site with clay/impervious soils, shallow groundwater table, known pollution, etc.
- ❑ Disconnect all impervious surfaces (roofs, roads, driveways, patios, etc.) and direct flow to vegetated areas
- ❑ Manage stormwater runoff (including rainfall and snowmelt) and pollutants as close to the source as possible to minimize costs of storm drain pipes and other conveyance features
- ❑ Consider LID runoff management measures that can capture/manage stormwater from adjacent impervious areas
- ❑ Consider multipurpose benefits of stormwater management/LID techniques/facilities. For example:
    - ❑ Preserved or new natural areas can provide habitat for wildlife and increase aesthetic value for the community
    - ❑ Recreation areas can be located in networks of open space or green corridors or dual-purpose detention facilities
    - ❑ Pervious parking areas can be combined with sub-surface detention facilities such as cisterns and/or infiltration chambers
    - ❑ Developments integrated with natural areas and/or community open space can have higher property values
    - ❑ Adding interpretive signage can provide educational value
- ❑ Estimate construction and maintenance costs

STEP 8 – Design/Size the LID Measures

Perform engineering design and calculations to develop the structural LID components. The calculation methodology and design should be consistent with the County's recommended or accepted design criteria for stormwater management, including volume/peak rate control, water quality treatment, and any other factors specified by the agency. Additionally, the fact sheets in Chapter 4 of the Guidebook will be helpful.

Iterative Process
Step 6. SELECT LID Measure
Step 7. LOCATE LID Measure
Step 8. SIZE LID Measure; if feature does not work, then go back to Step 6 to select another LID Measure.

STEP 9 – Refine Preliminary LID Design Plan Based on Stormwater Management Objectives

Developing a stormwater management program using LID principles and practices is a dynamic process. Evaluate the design to see if it meets project stormwater management objectives.

STEP 10 – County Project Application/ Submittal Review

Submit the application to the County for evaluation of the LID design to determine if it is acceptable. If the County requires revisions, go back to Step 6 and repeat the LID selection and design process.

>>END OF LID CHECKLIST

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